

Environmental Management - Grand Junction Office



# Moab UMTRA Project Flood Response Summary 2008

January 2009



U.S. Department  
of Energy

## **Office of Environmental Management**

**Moab UMTRA Project  
Flood Response Summary 2008**

**January 2009**

**Moab UMTRA Project  
Flood Response Summary 2008**

**Revision 0**

**Review and Approval**

*KG Pill*

*1/27/09*

Kenneth G. Pill  
TAC Ground Water Manager

Date

*for Thomas D. Ritchey*

*1/28/09*

Joseph D. Ritchey  
TAC Senior Program Manager

Date

## Revision History

<b>Revision No.</b>	<b>Date</b>	<b>Reason/Basis for Revision</b>
0	January 2009	Initial issue of Moab UMTRA Project Flood Response Summary 2008 (DOE-EM/GJTAC1774).

## Table of Contents

<b>Section</b>	<b>Page</b>
Acronyms and Abbreviations .....	iv
<b>1.0 Background .....</b>	<b>1</b>
1.1 Flood Mitigation Plan .....	1
<b>2.0 Chronology .....</b>	<b>1</b>
2.1 March 2008 .....	2
2.2 April 2008 .....	2
2.3 May 2008 .....	3
2.4 June 2008 .....	6
<b>3.0 Lessons Learned.....</b>	<b>7</b>
<b>4.0 Summary.....</b>	<b>8</b>

## Appendices

Appendix A. May Photos.....	A-1
Appendix B. June Photos.....	B-1
Appendix C. Backwater Channel Photos.....	C-1
Appendix D. Internet Resources .....	D-1

## Acronyms and Abbreviations

bgs	below ground surface
cfs	cubic feet per second
ft	feet
NOAA	National Oceanic and Atmospheric Administration
USGS	U.S. Geological Survey

# Colorado River 2008 Spring Runoff Response Summary

## 1.0 Background

The Moab Uranium Mill Tailings Remedial Action (UMTRA) Project site (Moab site) is a former uranium ore processing facility located about 3 miles northwest of Moab, Utah, and lies on the west bank of the Colorado River at the confluence with the Moab Wash. The Moab Interim Action Well Field is located 100 feet (ft) west of the bank of the Colorado River.

Above normal snowfall in the Rocky Mountains during the 2007 and 2008 winter had increased the likelihood of abnormally high runoff in the Colorado River. The Moab site is located on approximately 3,500 ft of Colorado riverbank and is transected by the Moab Wash, so site protection from flood damage is essential.

Stream flow of the Colorado River has been collected by the U.S. Geological Survey (USGS) at gaging station 09180500 near Cisco, Utah, since 1914. This station, located approximately 35 miles upstream of the site, is the closest station and provides the most complete data set representing river flow passing the site. There are no significant tributaries between the gaging station and the site, with the stream flow data collected downstream from the confluence between the Colorado and Dolores Rivers.

During spring 1984, the Colorado River flow at the USGS Cisco station reached 70,300 cubic feet per second (cfs) on May 27 and subsequently flooded the Moab site up to the toe of the tailings pile. The flooding was the result of a higher than average snowpack in the Upper Colorado River Basin. In spring 2005, an intense heat wave led to rapid snowmelt, and the USGS Cisco station recorded flows up to 40,200 cfs on May 25 that flooded just north and south of the well field. Using observational data from these 2 years, river flow action levels were implemented in order to ensure no property loss during spring 2008 runoff.

### 1.1 Flood Mitigation Plan

A *Flood Mitigation Plan* (DOE-EM/GJ1640) was created in May 2008 to differentiate actions to be taken by the Technical Assistance Contractor and the Remedial Action Contractor in preparation of possible flood conditions. The document identified three river flow action levels in which specific tasks must be completed to protect site property. The action levels were designated for Colorado River flows of 15,000 cfs, 25,000 cfs, and 30,000 cfs, when the 2-week prediction was 40,000 cfs or greater.

## 2.0 Chronology

The following includes a chronology of events of the spring 2008 above average Colorado River runoff and how the increased flow affected the Moab site.

## 2.1 March 2008

- The National Oceanic and Atmospheric Administration (NOAA) forecasted the seasonal runoff volume to be 138 percent of average.
- Sandbags were ordered, and the preliminary details for the *Flood Mitigation Plan* (DOE-EM/GJ1640) were discussed.
- All of the well points along the riverbank and river edge were capped, and extensions were added to the Configuration 4 riverbank well points.

## 2.2 April 2008

- Week ending April 4, NOAA forecasted the seasonal runoff to be 140 percent of average at the Cisco Gaging Station. River flow at the Cisco gage varied from 5,880 to 7,410 cfs (Figure 1).
- Week ending April 11, 400 sandbags were stockpiled on site. River flow at the Cisco gage varied from 7,490 to 7,980 cfs (Figure 1).
- Week ending April 18, elevation surveys were conducted across the river berm and the berm that runs along the southeast end of the tailings pile. The purpose of the survey was to indentify low portions of the berm and to compare elevation data onsite. River flow at the Cisco gage varied from 7,080 to 11,100 cfs (Figure 1). The snow pack snow water equivalent exceeded the maximum measured in the Upper Colorado Basin during this week (Figure 2).
- Week ending April 25, reject sand was ordered and placed along the lower areas of the berm, and an extra 500 sandbags were ordered, bringing the total to more than 750 sandbags on site. River flow at the Cisco gage varied from 9,490 to 14,700 cfs (Figure 1). Photos were taken of the backwater areas to document the preflood channel morphology (Appendix C). By April 22, the backwater channels adjacent to the site were inundated with water when flows reached approximately 13,000 cfs.
- The highest daily average flow in the month of April 2008 was 14,700 cfs on April 25 (Figure 1).

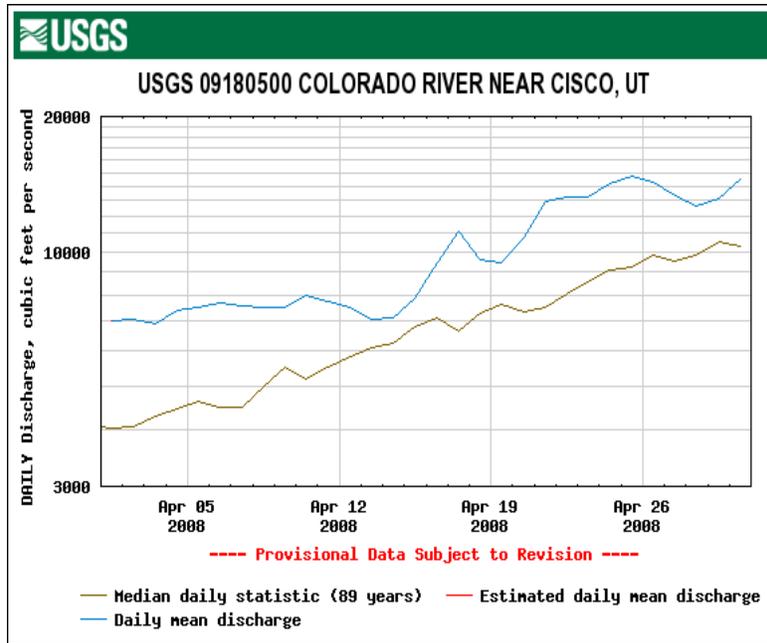


Figure 1. April 2008 Colorado River Daily Mean Discharge and the Station Average Discharge Measured at the USGS Cisco, Utah, Gaging Station.

### 2.3 May 2008

- Week ending May 2, the well field storage trailer, port-a-potty, and shed were relocated from the well field to higher ground near the trailer staging area. These structures were moved before the action level designated in the *Flood Mitigation Plan* (DOE-EM/GJ1640) due to personnel issues and scheduling. River flow at the Cisco gage varied from 12,700 to 16,700 cfs (Figure 3), or 118 percent of average. The snow water equivalent was above average for this week (Figure 2).
- Week ending May 9, NOAA predicted the seasonal runoff volume to be 133 percent of normal, and the snowpack in the Upper Colorado River Basin was 129 percent of normal. An additional 1,000 sandbags were ordered, and a total of 500 sandbags were filled and loaded onto pallets on site. The site-wide elevation data indicated that the river would begin to flood the well field when the gage on the river pump station reached 7 ft, which is equivalent to an elevation of approximately 3,967 ft (mean sea level). The gage measurements versus river flow were recorded throughout May and June 2008 (Figure 4). River flow at the Cisco gage varied from 12,600 to 20,400 cfs (Figure 3), or 102 percent of average for the week.

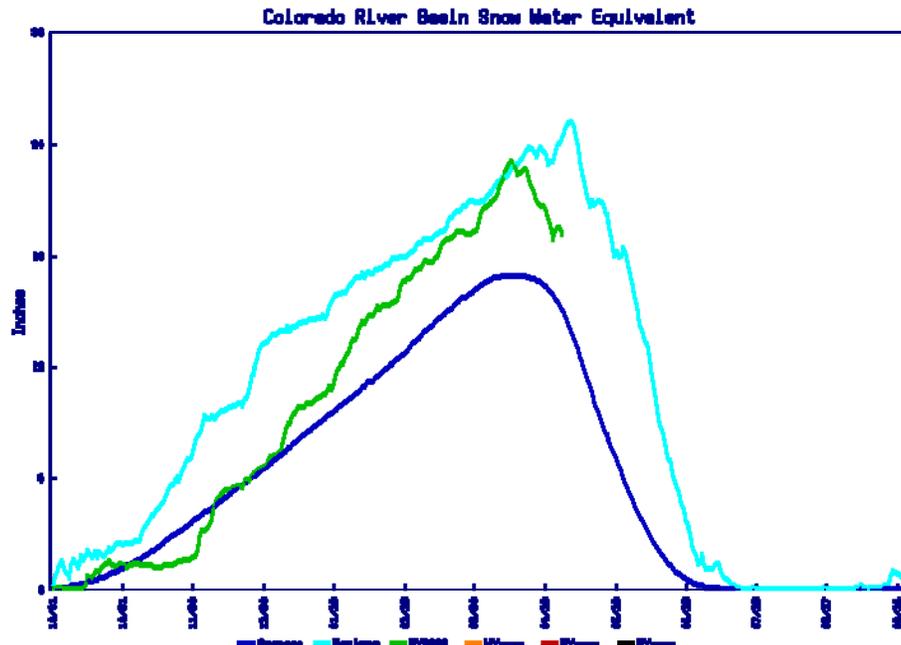


Figure 2. Snow Water Equivalent for the Upper Colorado River Basin During the First Week of May 2008. The Light Blue Line Represents the Maximum Snow Water Equivalent Observed, the Dark Blue Line Indicates the Average, and the Green Line Represents the 2008 Conditions.

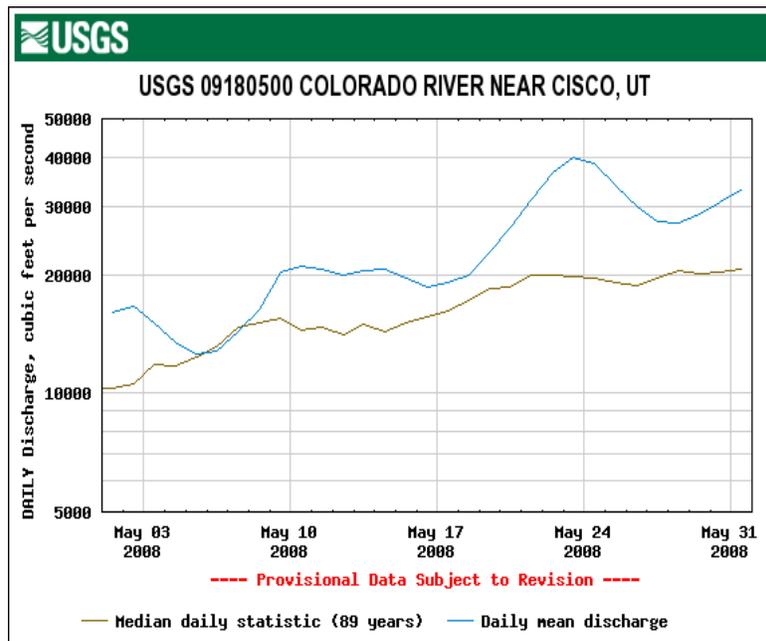


Figure 3. May 2008 Colorado River Daily Mean Discharge and the Station Average Discharge Measured at the USGS Cisco, Utah, Gaging Station.

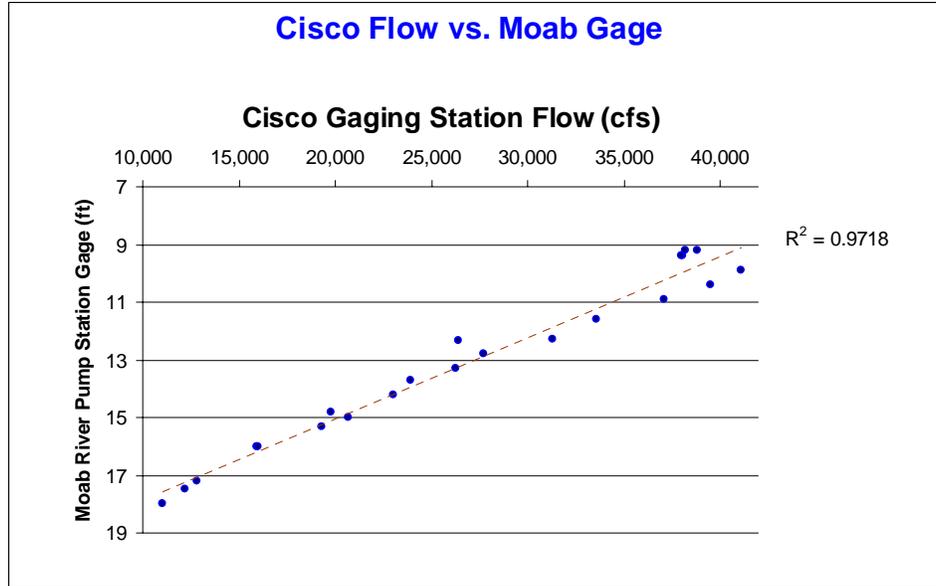


Figure 4. A Comparison of the Colorado River Flow at the Cisco Gage and the Staff Gage at the Moab Site Freshwater Pump Intake Structure.

- Week ending May 16, the snowpack was 154 percent of normal. The well field extraction rate was increased in order to ensure sufficient volume in the evaporation pond in preparation for well field shutdown due to high river flow. River flow at the Cisco gage varied from 18,700 to 20,800 cfs (Figure 3), or 115 percent of average for the week.
- On May 21, NOAA forecasted the river flow to reach over 40,000 cfs on May 23 (Figure 5). In response, the extraction wells were shut down, and the controllers and flowmeters were removed from the vaults. Sandbags were placed around the infiltration shed, transformers, along the low portions of the berm, along the Moab Wash (at the north end of the well field and across the well field access road), and across the road at the south end of the well field (Appendix A). Extra supplies and materials, such as the metal Configuration 2 vault lids, were removed from the well field and brought to higher ground. The snowpack was at 144 percent of average. The highest daily average flow for the month was 40,100 cfs on May 23 (Figure 3). A rapid moving cold front caused an abrupt decrease in river flow, possibly preventing significant flooding on site. The river was approximately 1 ft from the sandbags on the berm in most locations. The adjacent (Policaro) property flooded across the access road, and the well field access road was blocked by water from Moab Wash (Appendix A). River flow at the Cisco gage varied from 19,100 to 40,100 cfs (Figure 3). The average flow was 122 percent of average during the week, and the snow water equivalent was still above average, but had significantly decreased (Figure 6).
- Week ending May 30, the well field remained nonoperational, and the river flow at the Cisco gage varied from 27,100 to 38,500 cfs (Figure 3), or 141 percent of average for the week.

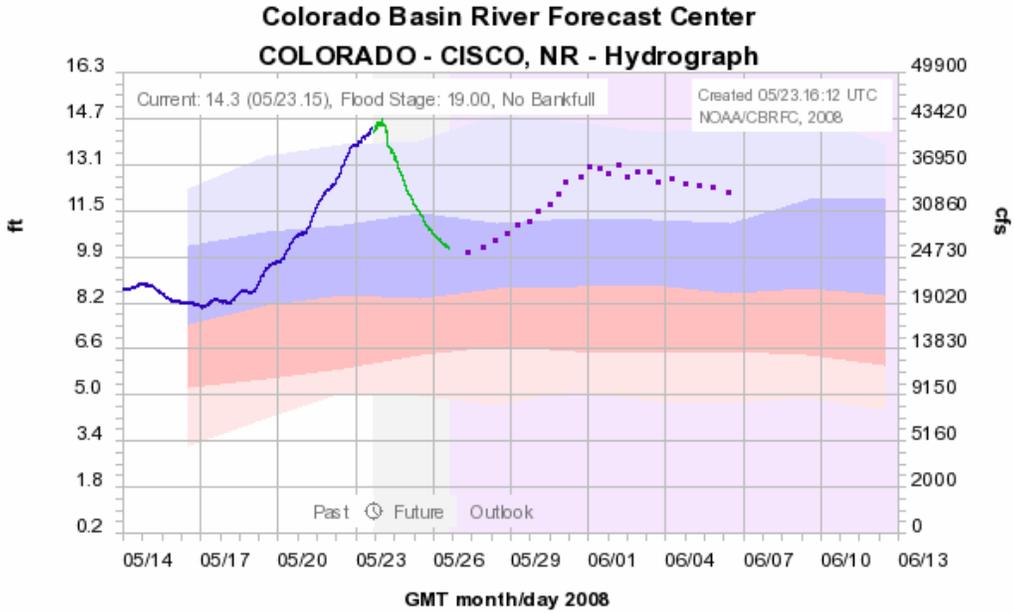


Figure 5. The Hydrograph on May 21 that Indicated Flows Would Reach Nearly 43,000 cfs by May 23.

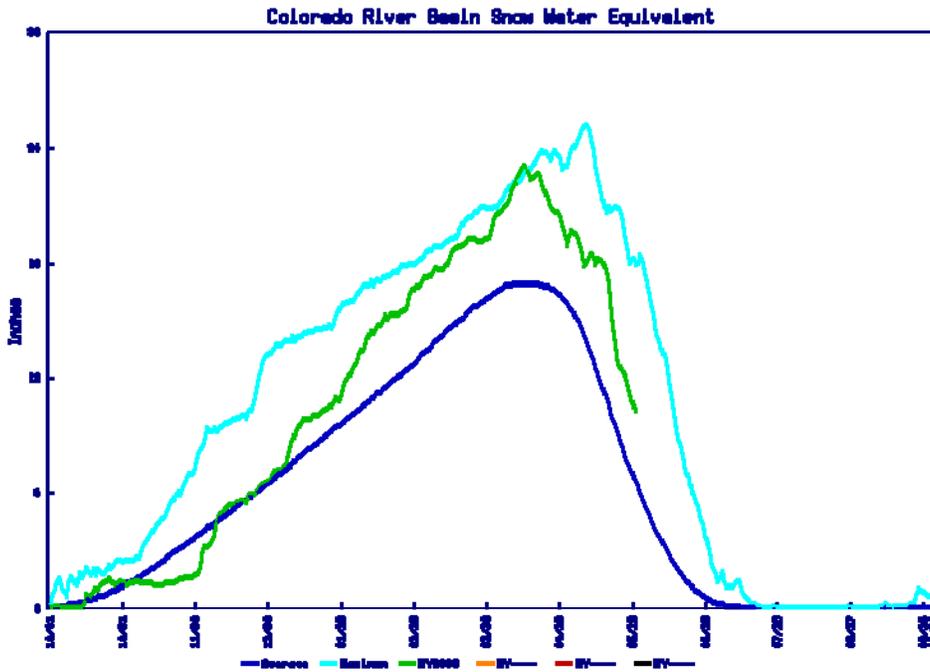


Figure 6. By Late May 2008, the Snow Water Equivalent Had Greatly Decreased from Early May 2008, but Was Still Above Average.

## 2.4 June 2008

- Week ending June 6, the river peaked again at 39,500 cfs on June 4 (Figure 7), and the water continued to enter the adjacent (Policaro) property. It was noted that approximately 6 inches of ground water had seeped into the Configuration 4 and Infiltration Trench vaults. On June 4 the ground water was approximately 4 ft below ground surface (bgs) in the well field. The extraction system remained nonoperational during this week. At this time, the snowpack was 139 percent of average. River flow at the Cisco gage varied from 32,900 to 39,500 cfs, and the average flow was 146 percent of average during the week (Figure 7).
- Week ending June 13, the snowpack was 128 percent of average. River flow at the Cisco gage varied from 24,600 to 31,000 cfs (Figure 7), and the average flow was 127 percent of average during the week.
- Week ending June 20, Configurations 1 and 3 were brought back online June 19. The snowpack was 112 percent of normal (Figure 8). River flow at the Cisco gage varied from 21,000 to 26,900 cfs (Figure 7) or 102 percent of average for the week.
- Week ending June 27, Configuration 4 was brought back online on June 25. At this time, the well field was entirely back to prunoff operational status. River flow at the Cisco gage varied from 20,700 to 26,400 cfs.

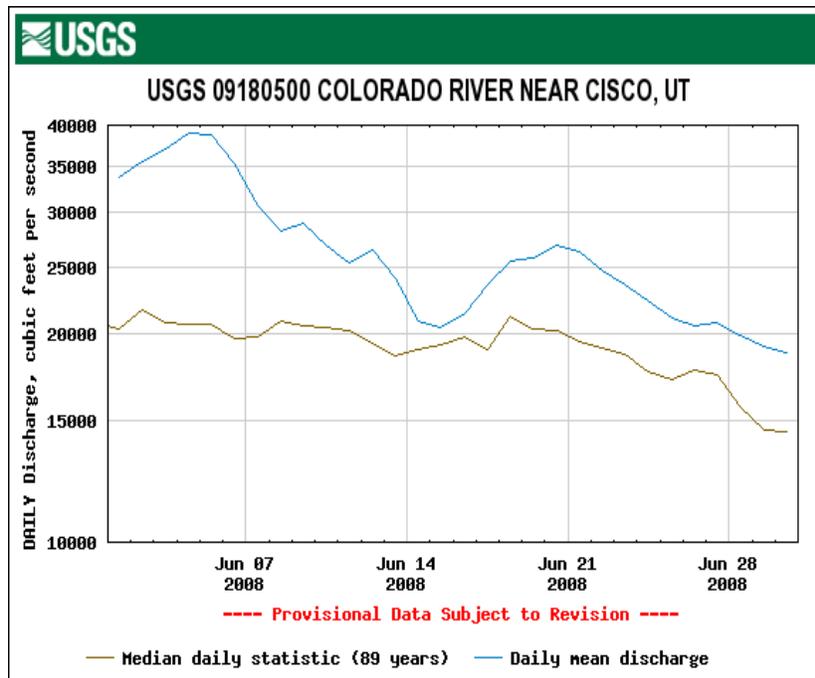


Figure 7. June 2008 Colorado River Daily Mean Discharge and the Station Average Discharge Measured at the USGS Cisco, Utah, Gaging Station.

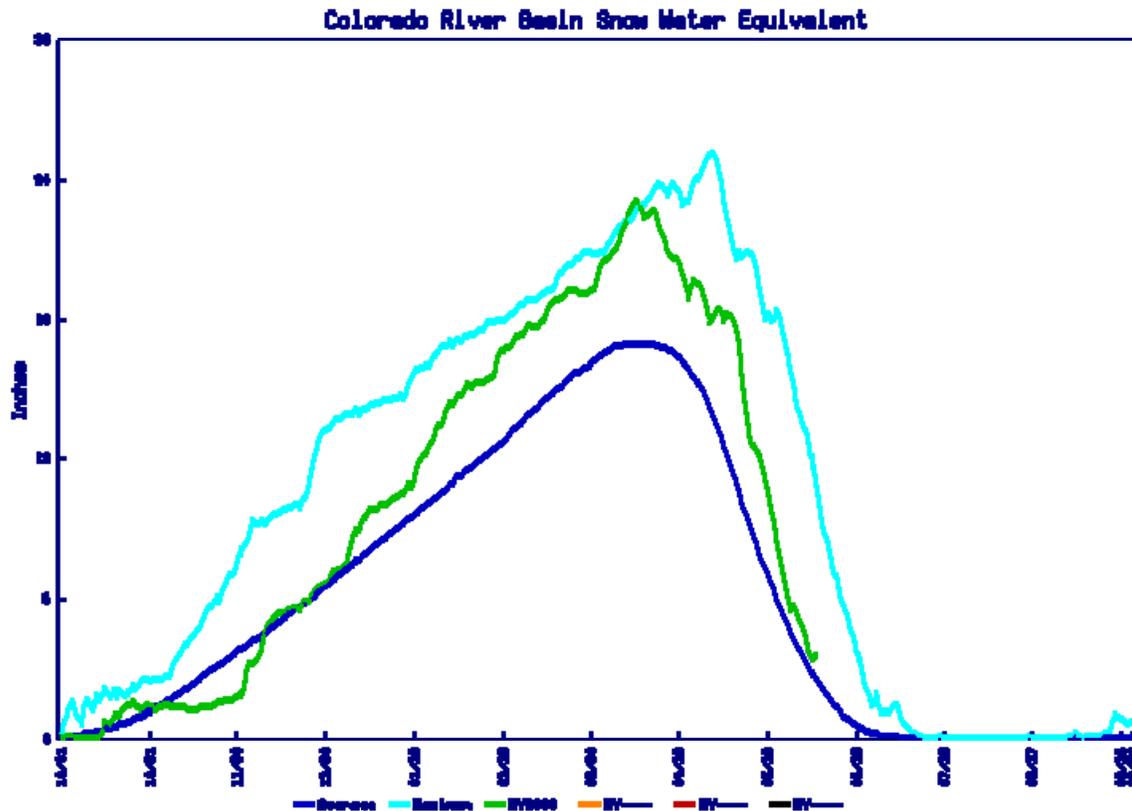


Figure 8. By Mid-June 2008, the Snow Water Equivalent Was Near Average.

### 3.0 Lessons Learned

The *Flood Mitigation Plan* (DOE-EM/GJ1640) identified river flow action levels in which certain tasks were to take place. Many of the items listed in the action levels were completed before being required, mainly due to personnel issues and scheduling constraints. In addition, NOAA river flow predictions are not always accurate and can change throughout the day, so it may be necessary to complete all of the tasks within a short time frame.

Throughout the spring runoff season, the painted gage on the freshwater pump was monitored in order to relate the Cisco Gage to the river flow near the Moab site. While using this gage was helpful in determining the river elevation, it is difficult to read and may not be accurate. A USGS river gage with large ticked number indicators was purchased after the runoff event and will be installed in early 2009. This will allow a more accurate documentation of the river elevation at the Moab site.

Based on the river flows measured at the Cisco station and the actual elevation measured at the site, the conservative action levels may be updated. Extrapolating the river stage elevation data collected from the site pump intake structure, the well field would not flood until the river stage measures 7 ft on the gauge (based on elevation). Still adhering to the use of a conservative action level, flows in excess of 45,000 cfs can be considered as the level at which the well field berm located on the river bank will be breached.

After the flood waters receded from the backwater channels and adjacent properties, the mosquito population was extensive. It would be beneficial to schedule an appointment with Grand County Mosquito Abatement. Most of the mosquitoes were found near the backwaters, irrigation plots, and on the flooded portions of the adjacent (Policaro) property. The site was affected by the mosquitoes into the month of August.

#### 4.0 Summary

While the Colorado River flows increased to 39,000 cfs on both May 23 and June 4, 2008, the Moab site was spared from flooding and loss of property (Figure 9). The only observed flooding was on the adjacent (Policaro) property, along the Moab Wash, and in a few vaults in the well field. It should be noted that flooding along the adjacent property was greater in 2008 than in 2005, even though the 2005 flow was higher. The difference is likely due to the remediation and recontouring of that property which took place in 2007. As further remedial activities take place on the Moab UMTRA site, it is important to assess how an increased river flow may impact these locations.

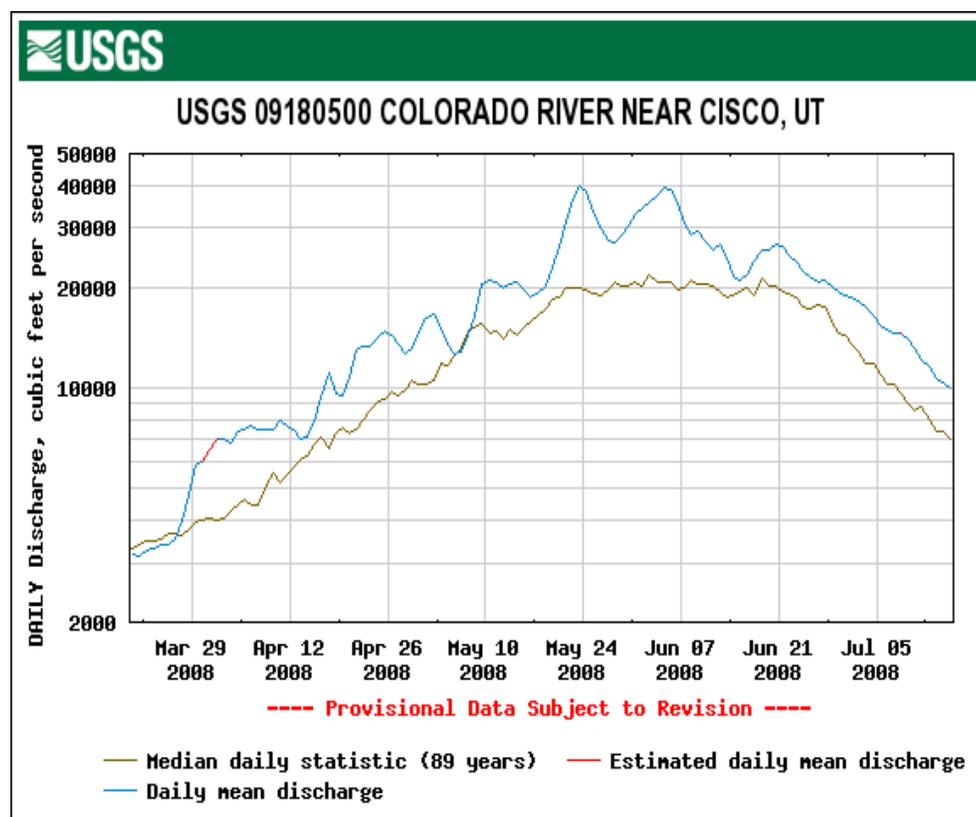


Figure 9. Late March Through Early July 2008 Colorado River Daily Mean Discharge and the Station Average Discharge Measured at the USGS Cisco, Utah, Gaging Station.

The river had reached several of the sandbagged areas along the riverbank, but never breached into the well field. River water backed up into Moab Wash past the lower crossing. The water was approximately 3 to 4 ft deep along the crossing, but remained confined to the channel.

During the peak river flow, the ground water table greatly increased from near 12 ft bgs to 4 ft bgs. Two of the Configuration 4 vaults and three of the Infiltration Trench vaults contained a few inches of standing water. This water originated from the rise in the ground water elevation.

The configuration of the backwater channels adjacent to Configurations 3, 2, and 1 changed dramatically. Approximately 3 ft of sediment was deposited in the intermediate portion of the backwater areas. The intermediate well points at Configurations 3 and 2 were completely buried, and one intermediate well point at Configuration 1 was also buried. Before and after photos of these backwater areas are located in Appendix C.

Several website resources were extremely useful in determining the extent and timing of the spring runoff (Appendix D). With early monitoring of the data provided on these websites and with the use of historical site information, it is possible to increase site preparedness for future high runoff events.

## Appendix A May Photos



*Sandbags Placed Along the Baseline Well Point Access Path.  
Photo Taken May 21, 2008.*



*Sandbags Placed Around the Transformer in Configuration 3.  
Photo Taken May 21, 2008.*



*Location of the River in Comparison with the Baseline Sandbags.  
Photo Taken May 21, 2008.*



*Sandbags Placed Around the Infiltration Filter Shed.  
Photo Taken May 21, 2008.*



*Sandbags Placed Around the Well Field Access Road.  
Photo Taken May 21, 2008.*



*The Well Field Access Road During Maximum River Flow.  
Photo Taken May 23, 2008.*



*Surface Water Flooded on the Adjacent (Policaro) Property Forming a Channel, Facing Northwest. Photo Taken May 23, 2008.*



*Surface Water Spillover on the Adjacent (Policaro) Property. Photo Taken May 27, 2008.*

## Appendix B June Photos



*Water in Configuration 4 Vault.  
Photo Taken June 5, 2008.*



*Water in Infiltration Trench Vault.  
Photo Taken June 5, 2008.*



*Moab Wash Crossing on June 5, 2008.*

## Appendix C

### Before and After Photos of the Backwater Channels



(a)



(b)

*Photos of the Backwater Area Adjacent to Configuration 3. Photo (a) Was Taken in March Prior to the Peak Runoff (Note the Well Points Behind the Brush). Photo (b) Was Taken in July After the Peak Runoff (Note the Missing Well Points and the Amount of Sediment Deposit Along the Banks of the Secondary Channel).*



(a)



(b)

*Photos of the Backwater Channel Adjacent to Configuration 2. Photo (a) Was Taken in March Before the Peak Runoff. Photo (b) Was Taken in July After the Peak Runoff (Note the Terraced Banks and the Amount of Sediment Deposit).*

## **Appendix D**

### **Internet Resources**

- NOAA Colorado Basin River Forecast Center–Provides a two week forecast for the Cisco Gage Station.  
<http://www.cbrfc.noaa.gov/river/station/flowplot/flowplot.cgi?CLRU1>
- U.S. Geological Survey (USGS) Cisco Gage Station–Provides real-time flow conditions, averages, and maximum and minimum flows.  
[http://waterdata.usgs.gov/ut/nwis/uv/?site\\_no=09180500&agency\\_cd=USGS](http://waterdata.usgs.gov/ut/nwis/uv/?site_no=09180500&agency_cd=USGS)
- NOAA Seasonal Runoff Forecast Center–Provides a percent average runoff forecast.  
<http://www.cbrfc.noaa.gov/westernwater/map.php?map=wsup>
- USDA Natural Resources Conservation Service-Snow Water Equivalent Update  
<http://www.wcc.nrcs.usda.gov/cgibin/snowup-graph.pl?state=CO>
- USDA Natural Resources Conservation Service-River Basin Snow Water Equivalent Plots  
[http://www.co.nrcs.usda.gov/snow/snow/watershed/current/daily/maps\\_graphs/index.html](http://www.co.nrcs.usda.gov/snow/snow/watershed/current/daily/maps_graphs/index.html)